

FIELD GUIDE

for use with ANSI/INFOCOMM 1M-2009
*Audio Coverage Uniformity (ACU) in
Enclosed Listener Areas*



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ACU Field Guide



***ANSI/INFOCOMM 1M-2009 Audio Coverage Uniformity (ACU)
in Enclosed Listener Areas
InfoComm International® Performance Standard***

ANSI/INFOCOMM 1M-2009 Audio Coverage Uniformity (ACU)
in Enclosed Listener Areas
InfoComm International® Performance Standard

Introduction

This field guide is designed to help you conduct the required in-field preparations, measurements, data collection, and data reporting for the ANSI/INFOCOMM 1M-2009, Audio Coverage Uniformity (ACU) in Enclosed Listener Areas, InfoComm International® Performance Standard. It is not designed to cover the complete details available within the Standard, which can be obtained from the ANSI online bookstore: <http://webstore.ansi.org>.

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How to Use This Field Guide:

This field guide is designed for audio technicians and engineers tasked with ensuring that rooms or venues with sound systems conform to the *ANSI/INFOCOMM 1M-2009, Audio Coverage Uniformity (ACU) in Enclosed Listener Areas, InfoComm International® Performance Standard*. By following the steps in this field guide, you will be able to take an ACU measurement and present your findings in the form of a test report from your company. You will have evidence that the equipment you are measuring has been correctly designed, installed, and adjusted. The ACU measurement is a way of making sure that everyone in a room is hearing the same audio level.

Safety First:

InfoComm International emphasizes the importance of using the safest setup and measurement methods possible. However, InfoComm International does not warrant the safety or efficacy of any procedures, methods, or practices contained herein.

Performances of activities described in this field guide require compliance with all applicable operations procedures under the direction of qualified personnel.

You should fully adhere to national, regional, and local safety regulations, and other codes.

Test and Measurement Equipment Manufacturers

References in this field guide to patented or proprietary devices do not constitute a recommendation for their use.

What the ACU Measurement Is:

Simply put, the ACU measurement is a way of making sure that everyone in a room is hearing the same audio level. This is not just a simple loudness

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measurement, like you may have measured with your sound pressure level meter in the past. This is loudness across the audible frequency range – from low to high. In order to measure this type of uniformity, it is necessary to think of the frequency range in pieces: lower, then middle, then higher frequencies. You will be measuring six of these “pieces” or, more properly, “bands.” You may be measuring two additional bands as well for a total of eight, if the venue is meant for high-quality music reproduction. This means that it is capable of producing very low and very high frequencies. You will measure each of these bands at each of the measurement locations spread across the room. The layout of where you measure represents where all of the people’s ears are. This is to make sure they are all hearing at the same level.

This does not mean that the sound system is perfect if the venue passes the ACU test. You are only checking for uniformity. However, there is a good chance that if the venue does pass, then the designers paid a lot of attention to the design of the sound system, and that many things will be in order. There are additional tests that need to be done in addition to ACU measurement to ensure that it is a good quality sound system. You may also be asked to make these while you are at the venue.

What the ACU Measurement Is Not:

To carry out the ACU measurement, you will be using equipment that is normally associated with frequency analysis, or equalization. The ACU test is not about the “EQ” of the room, the “house curve,” “feedback suppression,” or any of the ideas usually associated with frequency. You are using this equipment because we need to know how loud each location is within each of the frequency bands. The ACU measurement was deliberately designed so that you can use familiar equipment that you probably already have, and use it for multiple purposes. Certainly, while you are performing the measurements, you will get a lot of information about equalization, loudness, and perhaps issues the room may have like standing waves (room modes) or comb filtering (live and dead spots). However, let’s not get confused with all of that while taking the ACU measurement.

Before You Begin:

Before you begin to attempt to measure conformance to the ACU Standard in the field, numerous events should have happened:

DECISION TO PURSUE ACU CONFORMANCE: At some point during negotiations or the design process, your client would have made a decision to have your firm create a sound system that conforms to the ACU Standard. This could have been initiated by a design consultant, from your sales force, from the client, or from some mandate such as a corporate standards adoption policy. In any case, since you have been asked to test this system for ACU conformance, numerous people felt that it was important to this project and a worthwhile technical aspect to invest in an ACU conformant system.

DESIGN PROCESS: The sound system in the venue you are measuring should have been designed from the beginning with the idea that it will conform to the criteria in this Standard. The designers took many things into consideration, and they probably used acoustic/audio design software to help them decide what loudspeakers to use, where they will be mounted, and how they will be aimed. They would have started this process with your client, and possibly an architect, to decide where people will be sitting or standing, and how certain acoustic treatment materials will be installed in the room.

ACUP: While the designers were working on the drawings and designing the system, they created a drawing just for the purposes of this Standard, called an “Audio Coverage Uniformity Plan,” or “ACUP.” This drawing shows the outline of the room, where the people will be standing or sitting, and where you are to take the measurements. There are many requirements and ideas in the Standard itself that instructed the designer regarding how to calculate how many measurement locations there are, and where they are within the venue. They had to create this as a requirement of the Standard, to instruct you in where your measurements should be taken. They may also have put blank tables or charts within the plan drawing or on the side for you to fill in with the data you will be collecting. If possible, it is a good idea for you to go over this drawing with the designer, particularly if this is your first time at this process, and before you go to the venue.

ACUML: The measurement locations shown on the ACUP are called “Audio Coverage Uniformity Measurement Locations” (ACUML). You should know that there is a “tolerance” on these locations – how close to what is shown on the drawing that you have to be with your test microphone. You should also know at what height the measurements are to be taken: ACUMLs are three-dimensional. Usually this is at “ear height,” but if you are unsure you should check with the designer.

MEASUREMENT BANDS: One of the decisions that your client and the designer will have made is whether this venue is to be for “normal” speech and program audio reinforcement, or whether it is “high quality,” such as in a performing arts space. The normal ACU measurements will be taken across six octave bands, whereas the higher quality measurements will be across eight bands. It is imperative that this be clear to you before you begin measuring.

CONSTRUCTION PHASE: The project managers in your firm must have ensured that the designed system was being installed as planned by the designer. If things changed during construction, they should have been documented and the designer should have been consulted as to whether the system is still anticipated to conform to this Standard. You may or may not have been involved during the construction of this sound system, so if you have doubts about this it is better to check before going to the site.

BLANK TEST REPORT: The designers may or may not have created a blank test report for you to fill out; ideally they did so already. It is not recommended that this be created in the field, as everything you are to measure should be predetermined. There are different ways this may be presented to you: as a form on paper, as a PDF or text file, as an interactive spreadsheet, or in the two manners described above in the ACUP section. Any of these are acceptable, and the Standard gives an example of what one may look like, with spaces for all of the required information. See page 7 for instructions on how to download.

TEST EQUIPMENT: You should know before going into the field what test equipment you will be using and make sure you are familiar with it. There are several options of what test procedure and equipment you will be using. (See below.) Much of this equipment has different settings that you will have to select and switch on or off, so you need to know what these are to make sure your measurements are valid. For example, this Standard uses “flat,” or “unweighted” Decibel Sound Pressure Level (dB_{SPL} or dB)